

Alolkooy

El Niño



**The
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of the
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Islands
National
Marine
Sanctuary**

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SANTA BARBARA MUSEUM
OF NATURAL HISTORY

CHANNEL ISLANDS



NATIONAL MARINE
SANCTUARY

From the Bridge

Lessons from Nature

By Ed Cassano, Sanctuary Manager

When the Channel Islands National Marine Sanctuary was designated in 1980, a major threat to the marine environment—oil and gas exploration and production—was averted. Less than two years later, when the 1982–1983 El Niño hit, the Sanctuary faced an entirely different kind of challenge: the challenge of uncontrollable natural events.

The 1982–83 El Niño had a severe impact on the Sanctuary's natural resources. Kelp forests were ripped out, and warm water temperatures altered the types of marine life appearing in Sanctuary waters. At the time, with CINMS in its formative stages, Sanctuary personnel were not prepared to study or monitor a natural disturbance of that magnitude.

Today, with El Niño 1997 at our doorstep, we have already prepared and focused our research efforts on its potential impacts. This and other effort(s) extend throughout the biology research community on the South Coast, and several current research projects are documented in this issue of *Alolkoy*.

Working together, we will learn more than ever before about the impacts of El Niño in the Sanctuary, and achieve our goal of protecting and understanding Sanctuary resources, over both the long and the short term.

Editor's Watch

El Niño is Here!

By Cynthia Anderson, Alolkoy Editor

When it comes to weather, El Niño is the topic foremost on peoples' minds in Santa Barbara County this winter. Meteorologist Chris Crabtree reviews past and present El Niños in his article, "Strong El Niños and their Effect on Santa Barbara County," concluding that all signs show 1997–98 is shaping up to be a very wet El Niño year.

Robert DeLong and Sharon Melin, research biologists at the National Marine Mammal Laboratory, write about the effects of El Niño on Channel Islands pinnipeds, while research biologist Jack Engle explores the nearshore impacts of El Niño. LCDR Matthew Pickett covers the recent aerial photography survey of Sanctuary kelp beds to document the effects of El Niño. Researcher Steve Gaines at UCSB examines biogeographical boundaries around Point Conception and how El Niño might affect them.

A new feature in this issue is "Voices from the Sanctuary," an interview with an individual whose life and livelihood is closely connected with the Channel Islands National Marine Sanctuary.

Long-standing recipients of *Alolkoy* will note that this Winter issue does not include the CINMS annual report. The annual report will be published under separate cover in January and mailed in February. Call the CINMS office to request a copy.

Cover: El Niño conditions 1982–83 at the Santa Barbara Breakwater. ©1983 Dennis Meaney

Strong El Niños and their Effect on Santa Barbara County

By Chris Crabtree

The periodic warming and cooling of the Eastern Equatorial Pacific Ocean off the South American continent ranks as one of the great natural cycles of our planet. Known as the El Niño Southern Oscillation (ENSO), this phenomenon has warm and cold phases called El Niño and La Niña, respectively. Each phase of the ENSO can have far-reaching effects on atmospheric and oceanic conditions across the globe. This article will focus on the formation of strong El Niño conditions and their effect on past and potentially future weather conditions in the California region, since one of the strongest events on record presently exists in the Equatorial Pacific.

The Humboldt or Peruvian Current dominates the waters of the Pacific Ocean adjacent to South America. This cold ocean current flows north along the coasts of Chile and Peru, then turns west and warms as it moves out into the Central Pacific just south of the equator. One of the main sources of fuel for the Humboldt Current is the trade winds that blow from an easterly direction along the equator in the southern hemisphere. The most widely held theory on how an El Niño forms is that the trade winds weaken, which in turn weakens the Humboldt Current and allows the waters in the region to warm.

Substantial warming of sea surface temperatures (SSTs) in the Equatorial Pacific Ocean during El Niños can disrupt the thermal/pressure field that helps to maintain the trade winds, and a feedback relationship can develop which produces further warming of the SSTs. During strong El Niños, the trade winds have been known to reverse direction and blow from the west over portions of the Equatorial Pacific. This situation represents a dramatic imbalance to the prevailing atmospheric/oceanic conditions in the region, and it is only a matter of time be-

fore strong El Niños quickly tumble back to colder La Niña conditions. This cycle repeats itself about every two to six years.

One of the best parameters to measure ENSO conditions is SSTs, or more specifically, SST anomalies (deviations from the mean). Data from the National Center for Environmental Prediction show that the 1982-83 El Niño event is the warmest on record. However, the 1997 El Niño is a close second to this epic event and is presently the warmest on record for this time of year. This is significant, as the timing of the peak intensity of an El Niño to the onset of the northern winter may have as much effect on California weather as the maximum strength of an El Niño.

Other exceptionally warm events in descending order of strength occurred in 1972-1973, 1986-1987, and 1991-1992. The 1972-1973, 1982-1983, and 1997 events are considered to be strong El Niños based on SST anomalies. An extensive record of SST data taken along the coast of Peru imply that strong El Niño conditions probably also occurred in 1925-1926 and 1940-1941.

But how do strong El Niños impact weather conditions, and are these conditions predictable? Generally, the effects of an El Niño become more reliable the closer an area is to the ENSO region. In the South Pacific, the effects are often predictable: (1) higher atmospheric pressure in the West Pacific produces drought in Australia and Indonesia; and (2) lower atmospheric pressure and warmer water in the East Pacific produces torrential rains and floods along the

northwest coast of South America. To the north of the ENSO region, warmer water spreading into the Northeast Pacific often fuels an abnormal increase in tropical cyclone formation during the northern summer.

The effect of strong El Niños on weather conditions in California, however, is less clear. In theory, warmer SSTs in the Equatorial Pacific provide a heat source that increases convection and the formation of clouds in the ENSO region. As these clouds spread out into the northern hemisphere, they increase the moisture and strength of the westerly winds that bring us our winter precipitation. So, in theory, we get more precipitation in California during strong El Niños, especially in the southern part of the state. Unfortunately, since we are roughly 2,500 miles from the ENSO region, other forces that affect atmospheric circulation have the opportunity to divert this effect from our region.

Precipitation records from Santa Barbara do show a tendency for increased rainfall during El Niños. Rainfall data recorded at the El Estero station show that the annual average rainfall total of

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El Niño 1982-83 resulted in substantial damage to Stearns Wharf.

El Niño Web Sites

[http://www.elNino.noaa.gov/The National Oceanic and Atmospheric Administration \(NOAA\) El Niño Forecasts, Observations and Research Page](http://www.elNino.noaa.gov/The_National_Oceanic_and_Atmospheric_Administration_(NOAA)_El_Niño_Forecasts,_Observations_and_Research_Page)

<http://www.coaps.fsu.edu/lib/elNinolinks/>
Center for Ocean-Atmospheric Prediction Studies Library,
El Niño Resource Center

[http://nsipp.gsfc.nasa.gov/enso/NASA's El Niño and the current state of the tropical Pacific page](http://nsipp.gsfc.nasa.gov/enso/NASA's_El_Niño_and_the_current_state_of_the_tropical_Pacific_page)

[http://headlines.yahoo.com/Full_Coverage/Tech/El_Niño/Yahoo!'s "Full Coverage" page of El Niño](http://headlines.yahoo.com/Full_Coverage/Tech/El_Niño/Yahoo!'s_Full_Coverage_page_of_El_Niño)

<http://www.fema.gov/nwz97/elNino.htm>
The Federal Emergency Management Agency's (FEMA) El Niño Page

<http://www.tidepool.org/ElNino.html>
Tide Pools (a non-profit) weekly updated news on El Niño and Climate Change

<http://amdisa.ho.bom.gov.au/climate/glossary/elNino.shtml>
Bureau of Meteorology, Australia: About El Niño

<http://www.storm97.com/reports/nino82997b.html>
Lowe's Storm97 Hurricane Central

<http://www.enn.com/specialreports/elNino/>
The Environmental News Network's El Niño Special Report Page

<http://www.dir.ucar.edu/esig/enso/>
A Colloquium on El Niño-Southern Oscillation (ENSO): Atmospheric, Oceanic, Societal, Environmental, and Policy Perspectives

Compiled by Michael Wich,
CINMS Webmaster

Strong El Niños

Continued from page 3

11 past strong and moderate El Niño events dating back to 1925-1926 was 47 percent above the historical mean of 18 inches. However, the first, second, third, sixth, and eighth highest annual rainfall totals in the 130-year station record also occurred from these events: (1) 1940-1941 (45.3 inches), (2) 1977-1978 (40.4 inches), (3) 1982-1983 (39.7 inches), (6) 1994-1995 (33.6 inches), and (8) 1957-1958 (31.9 inches).

The station record also shows that dry years occurred during relatively strong El Niños: four of the 11 events produced less than the annual average precipitation totals, including 11.6 inches during the moderately strong 1986-1987 event. Hence, it is not a sure thing to say that moderate to strong El Niños will generate excessive rainfall, at least in the Santa Barbara region. But past events show that the odds are in favor of increased rainfall.

The 1982-1983 event demonstrated the effects of strong El Niños on California's marine environment in severe terms. Exceptionally large and consistent ocean swells during the winter ripped out coastal structures and kelp beds up and down the coast of



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The aftermath of El Niño 1982-83. El Niño 1997 may be of equal or greater intensity.

Southern California. A surge of warm water into the region brought pelagic species that usually make their homes in the tropics. Local species that thrive on the prevailing cooler waters floundered. Many of these events have already occurred in California this summer and fall. One of the most incredible events presently happening in the Santa Barbara Channel is that sea levels are averaging about

one foot above normal due to thermal expansion of the Eastern Pacific waters.

The best match for our present El Niño appears to be the epic 1982-1983 event. Part of this conclusion is based on forecasts of the ENSO cycle, which show that the 1997 event will quickly return next spring to La Niña conditions, similar to the 1982-1983 event. However, one of the many problems encountered in trying to predict weather conditions for this winter, based on the conditions of the 1982-1983 winter, is that a very unique event occurred during the infant stage of that El Niño. In April 1982, the El Chichon volcano in Southern Mexico exploded massively into the stratosphere. This event may have had as much to do with altering weather conditions during the 1982-1983 winter as the prevailing ENSO condition. One theory states that the El Chichon eruption helped to strengthen the 1982-1983 El Niño to its epic proportions!

Fortunately for El Niño researchers, our present El Niño is not contaminated with a significant volcanic eruption, making it invaluable as a reference point for future El Niño analyses. It remains to be seen what this winter will hold for weather conditions in California. Initial research on the subject by this author in September failed to provide a convincing prediction. Since then, however, the signs appear to be much clearer: with larger than average ocean swells experienced this fall and a sudden flurry of storms that have produced twice the normal rainfall in Santa Barbara for the month of November, the inevitable may be just around the corner.

Chris Crabtree is a meteorologist who has lived in Santa Barbara since 1974. He recently completed a study on El Niño patterns and rainfall for the Santa Barbara County Flood Control District.

El Niño Impacts on Channel Islands Pinnipeds

By Robert DeLong and Sharon R. Melin

There have been five different strong El Niño events in the past 25 years while biologists from the National Marine Mammal Laboratory have been studying pinnipeds at San Miguel Island. The El Niños of 1972 and 1987 had no detectable impact on seals and sea lions on San Miguel, but the El Niños of 1983, 1992, and 1997 had dramatic impacts on one or more of the populations' rates of pup births, pup growth, and survival.

The 1983 El Niño was the most powerful event yet recorded in California. On San Miguel Island, northern fur seal pup births declined 60% from the preceding year—in a population which had experienced a 20% annual increase in pup births for the preceding 10 years. Fur seal pup growth declined, and based upon resightings of tagged pups, it appeared that no pups from the 1983 cohort survived.

Similar impacts were seen on California sea lions at all rookeries in the Channel Islands, where pup production declined between 30% and 71%. Although more difficult to demonstrate scientifically, juvenile and adult female mortality also appeared to increase during that El Niño. California sea lions required six years and northern fur seals, eight years before the number of pups born reached levels equal to those observed in 1982. We interpret this as evidence that adult and juvenile female mortality increased during 1983 and 1984.

These changes in northern fur seal and California sea lion health appear to be caused by El Niño-associated changes in marine mammal food availability. Pregnant and lactating females have difficulty finding adequate food supplies to support healthy pregnancies and maintain normal milk production. Consequently, pups grow more slowly, and more pups die of starvation and disease.

How does El Niño cause decreased pinniped food availability? There is substantial media focus on warm sea surface temperatures during the El Niño. But more important are oceanographic changes (decreases in upwelling and deepening thermoclines) responsible for decreased levels of nutrients in the top 40 meters of the water column. Fewer nutrients mean decreased phytoplankton production, as well as decreased production of zooplankton and nekton. When food production decreases, existing populations of fish and squid tend to move farther north or deeper in the water column to find cool water. The net effect is that prey becomes less available for seals and sea lions, and probably for other marine mammals that reside in the Southern California coastal marine ecosystem.



Laura Gorodetzky

Young sea lion pup showing signs of nutritional stress at Point Bennett, San Miguel Island.

During the June-September 1997 pupping and breeding season, before oceanographers could agree there was an El Niño in California waters, northern fur seals and California sea lions at San Miguel Island already showed signs of nutritional stress. Pup mortality increased dramatically for both species, and it is possible that few pups born in 1997 will survive their first year.

At this writing (late November 1997), it is unclear whether warm conditions associated with this El Niño will continue to intensify, remain much the same, or dissipate before the 1998 fur seal and sea lion breeding season. Should the El Niño intensify or remain the same, impacts on fur seal and sea lion populations in the California Channel Islands may be as great or greater than those seen during the 1983 El Niño.

Robert DeLong and Sharon Melin are research biologists in the California Current Research Program at the National Marine Mammal Laboratory. DeLong has worked on pinniped research at San Miguel Island for over 25 years, and Melin has worked at San Miguel Island for nine years.

Nearshore El Niño Effects: Disturbance and Renewal

By Jack Engle

Kelp disappears! Sea stars dissolve! Subtropical fish invade! Although there has been considerable publicity about El Niño effects on marine mammals, sea birds, and migratory fishes, changes to nearshore marine communities at the Channel Islands also can be dramatic. Kelp, rocky pinnacle, and sand ecosystems all have been altered in complex ways by high temperatures, low nutrients, changing currents, and storms associated with this year's El Niño.

The lush forests of giant kelp encircling the Channel Islands depend on cool, nutrient-rich water for survival and growth. Nutrient depletion related to the influx of warm water this summer has resulted in massive declines in kelp beds, especially at the southeastern islands. Even more damage may be inflicted by the powerful El Niño storms predicted for this winter.

The loss of kelp beds is devastating for the myriad creatures dependent on this giant alga for food and shelter. Kelp-eating crabs, snails (including abalone), and fishes starve. Sea urchins, lacking drift kelp, emerge from crevices and graze away remaining kelp plants. With the kelp "trees" gone, a host of other invertebrates and fishes lose critical microhabitats, and the rich underwater forest becomes a relatively barren subtidal plain. However, many kelp forests are resilient and can re-establish themselves fairly rapidly once cooler, productive conditions return.

The nutrient-poor surface waters characteristic of El Niño also cause a marked decline in productivity of the microscopic plants and animals that form the basis of key food chains. Current-swept habitats, especially steep-sided pinnacles, are dominated by filter or suspension feeding invertebrates that specialize in consuming this plankton

"soup." Sponges, sea anemones, sea fans, worms, barnacles, sand crabs, mussels, clams, bryozoans, and sea squirts all are devastated by the paucity of drift food. Higher up the food chain, carnivorous crabs, shrimp, snails, sea slugs, and fishes that prey on the sedentary plankton-feeders also suffer. Deterioration of rich pinnacle communities leads to sparse habitats dominated by bare rock, pink algal crusts, and a few opportunistic species.

A remarkable but poorly-known phenomenon associated with El Niño episodes is sea star "wasting disease." This contagious illness, apparently caused by a *Vibrio* bacterium, affects all species of local stars. During the warmest periods, mass mortalities occur as stars rapidly deteriorate into piles of skeletal ossicles. Widespread losses were documented during the 1982-83 El Niño. Since then, sea star populations slowly recovered at the cooler northwestern islands, but recovery was minimal at the warmer southeastern islands. The 1997 El Niño has again caused catastrophic sea star mortalities at the islands. Various sea cucumbers and sea urchins have died as well. Losses of these ecologically important spiny-skinned animals have altered the intricate balance of nearshore communities.

Other cooler-water life forms are stressed or die as a result of El Niño's warming. Examples include red-bladed algae, sponges, orange cup corals, rock crabs, red abalone, tunicates, sculpins, surfperch, and rockfish. Alternatively, warm southern currents bring abundant larvae of subtropical species, including



Bat star succumbs to "wasting disease."

©1997 Richard Hermann

Asparagopsis seaweed, spiny lobsters, coronado urchins, and fishes such as garibaldi, blacksmith, sheephead, bluebanded gobies, and moray eels. Some unusual creatures that recently have expanded their ranges northward include mantis shrimp, orangethroat pike-blennies, Guadalupe cardinalfish, rainbow scorpionfish, finescale triggerfish, and scythe butterflyfish.

The dynamic mix of disturbance and renewal determines the composition of nearshore communities. Concerns about El Niño effects predominate now. However, in the larger perspective, El Niño years represent the peaks of a warming trend influencing life at the Channel Islands since 1976. Aside from human impacts, the species present today reflect cumulative effects of over two decades of warm-water conditions. These changes include declines in kelp forests and cool-water species, and expansion of warm-water marine life.

Jack Engle, associate research biologist at UC Santa Barbara's Marine Science Institute, conducts long-term monitoring surveys of marine resources and coordinates the Tatman Foundation's Channel Islands Research Program.

NOAA Jet Maps Kelp Forests

By LCDR Matthew Pickett

Loaded with state-of-the-art cameras, computers, and satellite positioning equipment, NOAA 52, a Cessna Citation Jet aircraft, recently flew high over the Channel Islands to take precise, high resolution photographs of the Sanctuary's precious kelp forests. Over 200 9x9 color photographs will be developed and analyzed from flights over the coastlines of Santa Barbara, Santa Cruz, Santa Rosa, San Miguel, and Anacapa islands. By studying these photographs, the Sanctuary hopes to track any potential impacts to kelp forests from El Niño winter storms.

Kelp forests are among the richest and most productive marine communities in California coastal waters, with both biological and commercial value. Kelp itself is harvested for additives in many food and cosmetic products, while kelp forests provide food and habitat for numerous species, many of which are fished commercially or support sport fisheries. Among these are sea urchins and abalones, both of which rely on kelp for food. Since all these species are interdependent, kelp is a resource that must be managed to provide both short and long-term maintenance of these communities.

Faced with the possibility of damaging winter storms, the Sanctuary needed an accurate and efficient way to map the kelp forests. Working in cooperation with NOAA's National Geodetic Survey's Remote Sensing Division and NOAA's Aircraft Operations Center (AOC), the Sanctuary determined that GPS (global positioning system) controlled color aerial photography was the best way to get an overall picture of the existing kelp forests in Sanctuary waters. The photographs will be digitized and enhanced to map the kelp on the Sanctuary's Geographic Information System (GIS).

The aircraft used for this mission, Cessna Citation N52RF (call sign NOAA 52) is part of AOC's fleet of high-tech research aircraft based at MacDill Air Force Base in Tampa, Florida. AOC operates and maintains all of NOAA's

aviation assets and provides platforms for a wide range of projects and programs. NOAA 52 is used primarily to map and chart the nation's coastline for inclusion on nautical and aeronautical charts. Over the years, Pilots CDR Jon Bailey and LCDR Garner Yates have photographed the entire coastline of the United States, including Alaska and Hawaii. Outfitted with side-by-side large format cameras, a multi-spectral scanner, moving map display, and differential GPS, NOAA 52 proved to be the perfect platform for this job.

LCDR Matthew Pickett is pilot of the joint patrol aircraft shared by CINMS and the Monterey Bay National Marine Sanctuary.

Our McArthur Tour

By Gustavo Torrez and Jackie Herrera

Fifth Graders at Franklin School, Santa Barbara, CA

Have you ever been on a 175-foot ship? We have. Our Los Marineros classes at Franklin School got to visit the *McArthur*. The *McArthur* is a NOAA research ship that was here in Santa Barbara to study whales.

The *McArthur* was too big to come to shore, so we had to go there on the *Ballena*, a research boat of the Sanctuary. On the way to the *McArthur*, we saw a lot of sea lions stacked on top of each other on a buoy.

Finally, the *Ballena* stopped next to the *McArthur*. We had to put on life jackets and jump across. That was one of the most fun parts of the trip! Then, we went on a little tour. We saw a big buoy that the crew was going to put in the ocean to get information. We also saw a big net that is used to catch plankton to find out what kinds are in the ocean. We saw a lot of different kinds of equipment that the scientists use to locate fish, whales, boats, and other things in the water. We saw a glow-in-the-dark map. They let us use the binoculars to see far away and we saw our friends on the shore. We each got a chance to steer, too.



NOAA Aircraft Operations Center

The NOAA Cessna Citation aircraft was recently used to map Sanctuary kelp beds.



Laura Gondecky

Los Marineros students aboard the McArthur.

Voices from the Sanctuary

Mike McCorkle

By Sean Hastings

"Voices from the Sanctuary" is the first in a series of articles that will present a slice-of-life view of people who are closely connected with the Channel Islands National Marine Sanctuary. This first article features Mike McCorkle, a Santa Barbara commercial fishermen who has been fishing for 45 years.

I found Mike at the Santa Barbara Harbor on a rainy and windy October afternoon. For over an hour we discussed his life as a commercial fishermen, his perceptions of this year's El Niño conditions, and other important issues. Harbor visitors will recognize Mike selling his fresh catch off the Pie Face at the Saturday morning Fishermen's Market.

Hastings: What fisheries have you been involved in, and what fisheries are you currently active in?

McCorkle: I have used all types of fishing gear, including traps, gill nets, harpoons, lampara nets, trawling gear, and trolling tackle. With this gear I have pursued crab, lobster, sea cucumber, halibut, white seabass, swordfish, shark, barracuda, rock cod, ridgeback shrimp, salmon, yellowtail, and yellowfin tuna. About the only fisheries I have not been involved in are abalone and sea urchin.

Hastings: What kind of boat do you operate?

McCorkle: I have owned a number of different boats. Currently I own a blue 30-foot Monterey named the *Theresa Ann*. (The *Theresa Ann* will become part of the new Santa Barbara Maritime Museum.) My other boat, the *Pie Face*, is a 36-foot vessel rigged for dragging, trawling, and trolling. Between the two boats I manage to stay active in a variety of fisheries.

Hastings: Describe a typical day in your life as a Santa Barbara fisherman.

McCorkle: Each day begins early, between 2-3 a.m. I am usually back at the dock, and the boat's tied up, between 4-5 p.m. With two boats rigged for different fisheries, I can fish one species in the morning, come

back to port, offload the catch, and head out in the afternoon in pursuit of another species.

If you focus on one fishery and gear yourself only for that fishery, you set yourself up for disaster if that fishery declines, the market demand shifts to something else, or ocean conditions change, like we see during El Niño years.

Hastings: What changes have you seen in commercial fishing, and have you noticed any changes in the Santa Barbara Channel?
McCorkle: Being a commercial fishermen today is more of a struggle than in the past, mainly due to fishing regulations. Proposition 132, which banned the use of gill nets in state waters, took half of my business away overnight.

I have watched as harbor seals and California sea lions learned to fish off my net, sometimes following my boat and stealing my catch all day. If the seals don't eat the whole fish, they manage to damage the fish with bite marks. On many occasions I cannot shake the seals, unless I am fishing down deep, so I end up returning to port with an empty fish hull.

Hastings: How do you anticipate El Niño will affect your fishing this year?

McCorkle: Fishing has generally been poor this year—for example, halibut and white seabass catch has been spotty. Sea cucumber fishing was excellent earlier in the year, but as the water warmed up in May my catch went down dramatically. On the other hand, ridgeback shrimp catch is up, and we are seeing juvenile shrimp in greater abundance than ever before. Whether these changes are a result of El Niño is anyone's guess.

Hastings: What are your feelings toward CINMS?

McCorkle: I was involved during the designation process of the Channel Islands National Marine Sanctuary back in 1980.



Fisherman Mike McCorkle and his boat the *Theresa Ann*.

Sean Hastings

I see designating the Channel Islands as a marine sanctuary mainly as a move to keep oil interests away from the islands. Right now I'm concerned about the debate on designating harvest refugia, or no-take zones, around the islands.

Sean Hastings is a contract research and policy specialist with CINMS. He is also an avid sportfisherman and has fished commercially for king crab in the Bering Sea.

El Niño Sportfishing Bonanza!

Sportfishermen in Southern California have been treated to unusually large catches of typically warm water species, including yellowfin, big eye, and bluefin tunas; yellowtail; dorado (also known as mahi mahi or dolphin fish); bonita; and striped marlin. The albacore tuna fishing in colder waters from Morro Bay north has been phenomenal as well. Other unusual visitors include needlefish, triggerfish, and opah.

Key indicator species in El Niño years include the paper nautilus, jumbo squid, and pelagic red crab—all of which have been observed this fall in the Channel Islands National Marine Sanctuary.

Sanctuary Waves

Platform IRENE Pipeline Oil Spill

The NOAA aircraft assigned to CINMS and the Monterey Bay National Marine Sanctuary (MBNMS) was at the scene of the Platform IRENE Pipeline Oil Spill on September 29. CINMS staff participated in wildlife recovery and damage assessment via aircraft, vessel, and beach patrol. A laptop computer linked to the GPS on the aircraft was used to collect natural resource data, track oil spill clean-up efforts, and map the actual spill footprint. Via the R/V *Xantu*, CINMS was tasked with overall assessment and recovery of oiled seabirds on the water.

R/V *Ballena* Activities

From September to December 1997, the R/V *Ballena* and R/V *Xantu* continued to be used as working platforms for scientists to conduct marine-related research in and around CINMS. The following projects were supported: Plumes and Blooms, Red Abalone Population Study, Intertidal Monitoring, and Elephant Seal Behavior.

F/V *Lady Christine* Grounding

The F/V *Lady Christine*, an 80-foot steel hulled trawler, went aground on San Miguel Island on November 11. CINMS, along with CINP and the U.S. Coast Guard, responded to the emergency. No impacts to the crew, marine mammals, or seabirds were reported. CINMS

continues to monitor efforts to retrieve the vessel off the beach.



The F/V *Lady Christine*.

Ed Cassano

Underwater Archaeology

The most successful underwater mapping project of the 1997 field season was achieved at the site of the *Aggi*. A 265-foot-long steel sailing ship, the *Aggi* was built in Glasgow, Scotland in 1894. Working off the R/V *Pacific Ranger*, a total of nine divers representing CINMS, CINP, and CMAR (Coastal Marine Archeological Resources Group) spent four days mapping and documenting visible artifacts.

CyberDive: Sea Center GTE Uplink

On October 25, International Internet Day, CINMS cohosted an experiment in which several organizations partnered to produce two live cyberdives. Passage Productions produced the uplink; GTE Directories was the corporate sponsor; Lee Roth Media produced the cybercast; PictureTalk, PTK Interactive, and Skytron, Inc. (all based in Irvine, CA) provided live audio and video feed to the Internet and a giant two-sided computer screen; Systems & Software Consortium and EOS provided the Internet connectivity; and the Sea Center served as the main venue. The event was covered by CNN.



CINMS Slide Library

Laura Gorodezky on the *Delta* sub that explored Santa Cruz Canyon.

Submersible Dive in Santa Cruz Canyon

In October, CINMS education coordinator Laura Gorodezky participated in a submersible dive to 1,100 feet in Santa Cruz Canyon. CINMS teamed with CINP and NASA to provide a live Internet audio broadcast to an underwater area that has never been explored. Participants who logged on to a designated web site were able to hear a RealAudio presentation from the sub, ask questions from a web chat room, and read a live text transcription of the event.

Underwater Photography Workshop

In September, CINMS and the Santa Barbara Museum of Natural History cosponsored a successful underwater photography/video workshop with professional photographer Tom Campbell aboard the *Vision* dive vessel. Twenty-two workshop participants “hunted” with their cameras to capture the beauty of Sanctuary marine life on film. Paper nautilus shells were found during the trip, indicating warm water conditions associated with El Niño.

Biogeographic Boundaries and Species Distribution

By Steve Gaines

Although clams, snails, and crabs seem incapable of moving very far, part of their life cycle is extremely mobile. Most marine invertebrates and fish produce microscopic babies (larvae) that move great distances via ocean currents. If these larvae survive long enough to complete their development, they settle out of the plankton and metamorphose into adult forms. Part of the recent Sanctuary-sponsored research cruise on the NOAA ship *McArthur* involved towing large nets to sample larvae in the Santa Barbara Channel. Why would we want to stalk such tiny creatures? The answer lies on the mainland coast.

To most people, Pt. Conception is the place where California's coastline bends sharply to the north, creating a boundary between southern and central California. To marine ecologists, Pt. Conception is famous as a different kind of boundary—a biogeographic boundary. All species have borders that enclose the range of habitats and locations where they occur. Most species have unique distributions, but in a few locations, a large number of species share common borders. These locations also create sharp boundaries between areas dominated by distinctly different species. Pt. Conception is just such a biogeographic boundary.

Although marine ecologists have known about biogeographic boundaries like Pt. Conception for over a century, the cause of such boundaries remains largely unknown. Most speculation has centered on gradients in water temperature. All of the major marine biogeographic boundaries are at points or headlands where ocean currents converge and water temperature changes abruptly. Pt. Conception typically separates the colder waters of the California Current, which flows southward along the California coast, from the relatively warmer waters of a gyre circulating in the Santa Barbara Channel. The presumption has been that species borders cluster at Pt. Conception and other marine biogeographic boundaries because some species do better in warm water, whereas others do better in cold water.

Our research, however, suggests a different cause for marine biogeographic boundaries: the effect of currents on the movement of larvae. When an invertebrate releases its young, they begin a journey largely determined by the pattern of ocean currents. Our suspicion is that some destinations are essentially inaccessible to drifting larvae. Specifically, we hypothesize that the collision of currents that creates the temperature gradient at Pt. Conception also creates a barrier to larval movement—essentially forming a wall in the ocean. For example, the strong southward flows of the California Current could preclude the northward movement of even the most athletic larvae.

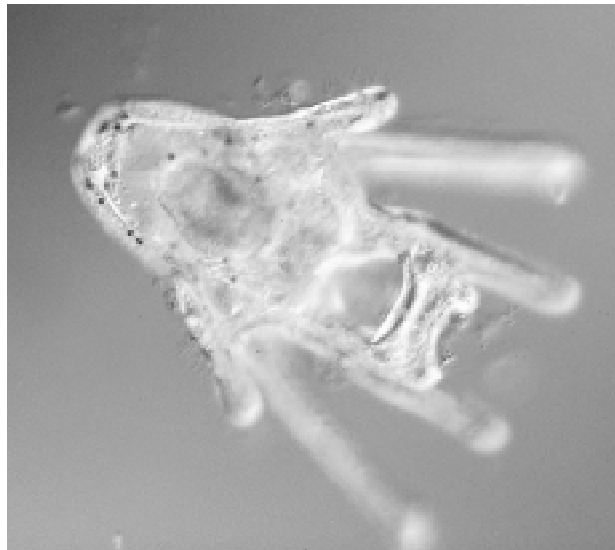
Our sampling of larvae on the *McArthur* is part of a large study in the Santa Barbara Channel to test this new hypothesis. By sampling larvae along transects that cross the boundary between California Current and Santa Barbara Channel waters, we are examining whether the collision of currents creates a barrier to larval movement. At the same time, we are studying the pattern of larval settlement along the shoreline, including the shores of the Channel Islands. Our preliminary findings support the hypothesis that the biogeographic boundary exists

largely because of barriers to larval movement.

These findings have important implications for how coastal ecosystems might change in the face of a variable climate. If the historical hypothesis of temperature barriers is correct, biogeographic boundaries like Pt. Conception may be unstable in the face of ocean warming. On the other hand, if barriers to larval movement are more important, the biogeographic boundary may be relatively stable in the face of temperature changes. Only changes in currents would cause species borders to move.

The 1997-98 El Niño may provide a test of this prediction since ocean currents in past El Niño years have changed dramatically, with strong northward flow along the entire coast of California. We have our nets ready!

Steve Gaines is the Director of the Marine Science Institute and associate professor in the Department of Ecology, Evolution & Marine Biology at the University of California, Santa Barbara.



Sand dollar larva.

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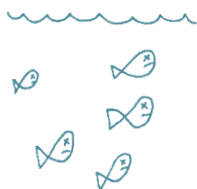


All Mixed Up

Unscramble the words and write them in the boxes provided. In order, write the circled letters in the bottom boxes to get the answer.

areetwh								
nmaalis								
nwid								
ierf								
tnlpas								
qraeout								
What is it?								

Get to Know El Niño



El Niño starts with a wind shift along the equator in the Pacific Ocean. This causes a rise in the water temperature along the eastern Pacific. The animals there either die or move north to cooler water. The warm water causes more clouds which means more rain and flooding in this area. In the western Pacific, there is less rain, which means less water for the plants and animals. This leads to droughts and fires.

For an explanation month-to-month with images, go to:
http://topex-www.jpl.nasa.gov/enso97/el_nino_1997.html

For a picture of the water temperature here in the Sanctuary, go to:
<http://cwatchwc.ucsd.edu/images/sca.gif>



Code Breaker

See if you can break the code and figure out the message!

● ■ ✕ □ ✕

□ ○ ✕ ■ ✕

✕ ✕ ■ □

□ □ ◆ □

◆ ○ □ □ ● ●

Clues:

● = e

■ = n

◆ = u

● = /



Dear Crabby



Dear Crabby,
Why is it called El Niño?
—A Puzzled Pal

El Niño, which means "the boy child," is named after the baby Jesus, because fishermen in Peru noticed the effects of El Niño around Christmas time.



Code Breaker Answer: El Niño is coming! Find your umbrella!

All Mixed Up Answers: weather, animals, wind, fire, plants, equator, El

If you have a question about the islands within the Sanctuary, please write to Dear Crabby at Santa Barbara Museum of Natural History, 2559 Puesta del Sol Rd., Santa Barbara, CA, 93105, or e-mail to: losmar@sbnature.org.

This page was written by fifth grade students in the Los Marineros program at Cleveland School, Santa Barbara, California.
Contributors: Ashlee O'Regan, Kyle Winnen, Frank Rodriguez, and Erica Canley.

If you have comments, suggestions, or submissions for this page, please send them to the *Alolkoy* office, Channel Islands National Marine Sanctuary, 113 Harbor Way, Santa Barbara, CA 93109.



U. S. Department of Commerce
National Oceanic and Atmospheric Administration
Channel Islands National Marine Sanctuary
113 Harbor Way
Santa Barbara, CA 93109

Address Correction Requested

Alolkoy

Need more information? Contact:

**Channel Islands
National Marine
Sanctuary**
113 Harbor Way
Santa Barbara, CA 93109
805/966-7107
Email: cinms@rain.org
Web Page: www.cinms.rain.org

**Channel Islands
National Park**
1901 Spinnaker Drive
Ventura, CA 93001
805/658-5700
Web Page: www.nps.gov/chis/

**Santa Barbara Museum
of Natural History**
2559 Puesta del Sol Road
Santa Barbara, CA 93105
805/682-4711
Web Page: www.sbnature.org

Sea Center
211 Stearns Wharf
Santa Barbara, CA 93101
805/962-0885
Web Page: www.sbnature.org/seacentr.htm

Things to Do, Places to Go

4th Annual Whale Festival

The whales are coming! Santa Barbara celebrates the annual migration of gray whales through the Sanctuary with the 4th Annual Whale Festival and the Week of the Whale. The Whale Festival will take place on Saturday, February 7 from 10 a.m. to 6 p.m. on lower State Street. The festival features food, music, crafts, educational booths, and the "Great Rubber Duck Race." Whale Corps naturalists will give talks throughout the day. For Whale Festival information, call (805) 884-4688, or visit www.sbweb.com/whales.

Week of the Whales

Whale festivities will continue with the Week of the Whale, February 8-13, at the Santa Barbara Museum of Natural History. Activities include a Whale Discovery Center, life-size gray whale model, information on El Niño, and whale films shown daily at 1:30 p.m. On February 8 and 13 at 7 p.m., the Museum and Sanctuary will present "In Our Own Back Yard: Close Encounters with the Whales of the Santa Barbara Channel."

The Week of the Whale is co-sponsored by the Sanctuary and the Santa Barbara Museum of Natural History. For more information, call the Whale Hotline at (805) 682-4711.

Gray Whale Expedition

Ocean explorer and film producer Jean-Michel Cousteau invites the public to participate in a Gray Whale Ex-

pedition scheduled for March 1998 at San Ignacio Lagoon, Baja California. Participants will study California gray whales migrating to Baja to calve and nurse their young. This adventure travel program is sponsored by the Jean-Michel Cousteau Institute. For more information, contact Laura Sullivan at (805) 899-8899.

"Dive into History"

On January 24, 1998, the Historical Diving Society will sponsor a "Dive into History." Doors open at 9 a.m. at the Garvin Theater, Santa Barbara City College. The day will feature lectures by Bob Kirby and Jean-Michel Cousteau, and demonstrations using the original 1860 Rouquayrol and Denayrouze self-contained diving equipment. Call 692-0072 for tickets and information (\$5 in advance, \$7 at door).

